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Cover

Another Astronaut Candidate?—Vice Premier of the People's Republic of China state council Deng Xiaoping "flew" the Space Shuttle back to Earth from space in a simulated flight at the Johnson Space Center during his February visit. A member of the official Chinese delegation stands to the rear of the premier.

Tables of Contents

Letter from Washington 3
New Satellite to Examine Earth's Stratosphere .. 7
Electrical Problems in Space to Be Studied 8
Worldwide Cooperative Study of Weather Begun 9
Education Centerpiece 11
HEAO 1 Mission Ends 13
Skylab Attitude Change Made 13
NASA Budget Plan for Fiscal Year 1980 14
New Computer Facility 16
Minority Firm Gets NASA Contract 17
Solar System at Senior Center 18
Papago Indians Receive Energy Boost 18
Presidential Certificate to NASA Man 19
Presidential Award to NASA Engineer 20
NASA Chemist Is National Inventor of the Year 20
Johnson Employee Invention Aids Shuttle Operation 21
New Director for Government/Industry Affairs 22
NASA People Receive Important Awards 22
Fire-Fighting Module Delivered to Coast Guard. 22
Lewis Deputy Director Leaves NASA 23
Federal Women's Program Coordinator Named. 23
Jupiter Observations Continuing 24
NASA Parachutist Sets Record 24
Patents for Inventions 26
Launches for 1979 27
Another Dividend from Air and Space 28

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Ann Weeks
Editor, Code LFD-10
NASA Headquarters, FOB 6
Washington, D.C. 20546
(Phone: 202 755-8348)

Letter from Washington

Dear Colleagues:

In my appearance before the House Committee on Science and Technology last year, we discussed the subject of future space programs and the need for both near- and long-term goals in space. Since that time, we have made significant progress both in establishing goals for the first decade of this new era in space and in transitioning to the Space Shuttle, the vehicle which will make this era a reality. The President's space policy, summarized in his remarks at the Kennedy Space Center on Oct. 1, and formally announced later that month, establishes the broad roadmap which will chart our course during this challenging period. It sets goals for our continued U.S. leadership in space science and applications and for full exploitation of the Space Shuttle's unique capabilities. The FY 1980 budget request represents important steps toward these goals in this threshold year.

Unfortunately, inflation continues as the country's most pressing problem, and the President's total budget, designed to reduce the Federal deficit to less than $30 billion, is understandably tight and austere. In this context, the NASA budget for fiscal year 1980 of $4.725 billion and the fiscal year 1979 supplemental request of $185 million for the Space Shuttle represent a strong Administration commitment to civil space and aeronautics programs. Moreover, the multiyear budget projection process has established future fiscal targets for NASA which offer some flexibility in the selection of new efforts over the next several years.

From an overall standpoint, excluding the supplemental request for the Space Shuttle, the budget total represents an increase over fiscal year 1979 of 7.8 percent, which is about equal to inflation. When the fiscal year 1979 supplemental amounts requested for the Space Shuttle and Civil Service pay increases are taken into account, the total increase is about 3.5 percent.

We now stand on the edge of a totally new perspective of space and how we do business there. We are on the threshold of the Shuttle era. The Space Shuttle, with its accompanying upper stages and Spacelab, will expand our present capabilities in space in ways which even now we do not fully appreciate. The President's space policy places paramount importance on the need to capitalize on this capability.

Beyond fiscal year 1980, the budget planning figures afford opportunities for the enhancement of Shuttle capabilities. Funds are requested in this budget to complete the definition of a thrust augmentation concept, which not only will meet projected payload requirements for the mid-1980s and beyond, but also allow for growth beyond the original specifications of the system—growth that can be phased into the operational era in a logical sequence as we learn to exploit the system's full capabilities.

The President's space policy calls for maintaining a position of leadership in space science and planetary exploration. This fiscal year 1980 R&D budget request for space science provides a growth of about 20 percent over the fiscal year 1979 level as a necessary step toward this objective. Ongoing support is provided for a program of planetary exploration, space-based astronomy, and a strong emphasis on understanding Sun-Earth relationships and interactions.

Planning estimates for the space science program beyond fiscal year 1980 include flexibility for new missions of the highest scientific priority. The missions currently under near-term consideration include the Gamma Ray Observatory, Venus Orbiter Imaging Radar, and a comet mission.

Perhaps the key to our third decade in space will be the exploitation of that medium for remote sensing and communications efforts to improve the quality of life on this planet. Space applications programs enhancing our understanding of weather, pollution and Earth resources form a cornerstone of the President's space policy. This budget request supports and reinforces ongoing applications R&D programs with a funding increase of approximately 20 percent over that provided in fiscal year 1979. This budget level will permit two limited but important initiatives —a multi-agency program to use remote sensing data for better crop forecasting and inventory, and a reentry of NASA into communications satellite R&D.

In aeronautics, our R&D request is some 14 percent over the level for fiscal year 1979. The positive impact of aeronautics sales on our balance of trade and leadership in world aviation in the face of steadily increasing competition from abroad dictates the need for continued support, especially in the programs aimed at strengthening our technology base. I will now discuss the programs supported by the budget in somewhat more detail.

The past calendar year was one of significant progress in testing, training and construction in the Space Shuttle program. Yet much remains to be done before the first manned orbital flight for which we have set a success-oriented target date of next Nov. 9. Hardware deliveries have now been phased to support the Nov. 9 target launch date. Barring unforeseen problems, we believe there is a reasonable chance to meet that date.

In fiscal year 1980, we are requesting a total of $610.5 million for Shuttle design, development, test and evaluation. A significant portion of this funding will be directed toward the four orbital flight tests presently planned for that fiscal year.

We are also requesting a total of $755.5 million for continued fabrication and assembly leading to an operational fleet of four orbiters, which were formally named last week: Columbia (orbiter 102), Challenger (orbiter 099, presently the structural test article), Discovery (orbiter 103), and Atlantis (orbiter 104).

In space flight operations, the total request of $467.3 million includes funding for flight hardware for the early STS operational flights. Essentially we have filled the Shuttle manifest for the first two years of STS operations. Funds also are included for Spacelab hardware, the Spinning Solid Upper Stage, and thrust augmentation for the Shuttle.

Our request of $70.7 million for expendable launch vehicles is earmarked for the Scout, Centaur, Delta and Atlas-F vehicles as we proceed with the STS.

Advanced programs, for which we are requesting a total of $13 million, will focus on mission options to enhance the unique capabilities of the Shuttle.

A total of $601.6 million is requested for fiscal year 1980 space science R&D programs. This amount is about $96 million over the fiscal year 1979 total. While no new flight programs are included, this request provides the necessary support for the continued development of the Space Telescope, the Galileo mission, the International Solar Polar Mission and experiments to be conducted on Spacelab missions. It will also continue or extend operations of current missions.

A total of $112.7 million is requested for continued development of the Space Telescope. This unique instrument will form the centerpiece of our astronomy program for the remainder of the 1980s and beyond. Based above the obscuring effects of Earth's atmosphere, it will detect objects 50 times fainter than those presently observable, and will expand the observable volume of the universe by a factor of more than 350.

To gain the maximum scientific return from the program we will establish a Space Telescope Science Institute operated under a long-term contract with NASA.

The major focus of our near-term planetary program will be the "Galileo" Jupiter orbiter and probe. This extremely challenging mission, scheduled for launch in early 1982, will use the full capability of the Shuttle and provide in-depth information on the Jovian atmosphere and its fascinating satellites. A total of $116.1 million is requested to continue Galileo development in fiscal year 1980.

Solar terrestrial research will continue at a strong pace. Central activities involve: the Solar Maximum Mission, designed to study the energies of solar flares and related events during the forthcoming period of maximum solar activity; and the International Solar Polar Mission, planned for launch in 1983, a joint mission with the European Space Agency. The two will give us our first look at the Sun's third dimension by flying two spacecraft over the north and south poles of the Sun.

The life sciences program, for which a total of $43.9 million is requested, will emphasize in-flight experimentation, thus taking advantage of the laboratory atmosphere which will be available in the Spacelab.

We are requesting a total of $344.4 million for space and terrestrial applications programs, an increase of $60.5 million over fiscal year 1979. Of this amount, $141.4 million will be applied to resource observations programs, with emphasis on agricultural research and on the continued development of Landsat D. This advanced Earth-observation satellite, the fourth in the Landsat series, is scheduled for launch in 1981 with a second-generation sensing instrument, the thematic mapper, as well as the flight-proven multispectral scanner.

A total of $117.2 million is planned for environmental observations programs. With the transfer of the upper atmosphere research program from the Office of Space Science to the Office of Space and Terrestrial Applications, environmental research

within NASA is now focused in Space Applications. Major thrusts of the Environmental Observations Program in fiscal year 1980 are directed at an understanding of the physics and chemistry of the environment, and identification of severe storm precursors.

A major initiative which will begin in fiscal year 1980 is a joint, cooperative program with the Departments of Agriculture, Commerce, and the Interior, and the Agency for International Development in crop monitoring and commodity production forecasting. NASA, building on experience gained in the Large Area Crop Inventory Experiment, will develop and test remote sensing techniques to provide both commodity production forecasts and early warning of changes affecting crop production or quality.

The President's space policy directs NASA to support U.S. leadership in communications satellite systems. NASA is proposing to re-enter selected areas of this sector of research and development. We will concentrate on the development of the technology required to increase the usable capacity of the radio frequency spectrum for communications satellites in geosynchronous orbit.

In the area of materials processing, the emphasis is on research and experimentation. We have now identified fourteen investigations for early Shuttle missions in such areas as crystal growth, containerless processing and fluid dynamics.

We are requesting $12.1 million for Technology Utilization. This program continues to provide important benefits to the Nation from aerospace research and development.

In aeronautics, our fiscal year 1980 R&D budget request of $300.3 million represents a 14 percent increase over the fiscal year 1979 level. Our primary efforts will be directed at strengthening the technology base, continuing progress toward energy-efficient aircraft, and continued noise, pollution and safety research.

Fiscal year 1980 marks the year of peak activity in our aircraft energy efficiency technology program, with total resources of $116.1 million. The program is aimed at providing improved technology leading to a major reduction in fuel requirements for transport aircraft.

Rotorcraft technology efforts will stress discipline advances to improve terminal operations, efficiency and flightworthiness. General aviation activities will focus on noise and emission reduction, crashworthiness and advanced low-cost avionics systems. Technology for vertical-takeoff-and-landing aircraft and high-performance aircraft will be conducted primarily in support of current and future military requirements.

A strong generic research and technology base has been the foundation of this country's leadership in aviation. In order to meet the ever-increasing challenge of competition from abroad, we must invest in the disciplinary areas of materials, structures, propulsion, avionics, and aerodynamics, upon which advanced aircraft will be developed.

Our space research and technology program, for which we are requesting $116.4 million for fiscal year 1980, will continue to support the needs of current and future space missions and to formulate approaches which will increase the reliability and efficiency of future missions. A broad spectrum of advanced technology disciplines will be supported. Progress also will be achieved in developing and demonstrating the technology necessary to provide a data information and management system, called NASA end-to-end data system, which will provide substantial increases in space-derived information at reduced cost.

A total of $3 million is proposed for continued work to identify the technology generated in our aeronautics and space program which has potential for major contributions to the solution of our energy problems. We also will continue our highly successful efforts in support of the Department of Energy in such areas as solar cells, solar heating and cooling, and wind machines. I am pleased to note that the President is requesting $8 million for DOE on solar power satellite research in fiscal year 1980, an increase of $3.5 million.

We are requesting a total of $332.8 million for continuation of tracking and data acquisition support for Earth-orbital spacecraft, planetary missions, sounding rockets, and research aircraft. The fiscal year 1980 workload remains high, with the Spaceflight Tracking and Data Network supporting an average of approximately 50 Earth-orbital applications and scientific spacecraft, and the Deep Space Network supporting a full complement of planetary missions.

Research and program management funds the performance of research, technology and test activities at NASA centers, and the planning, management and support of contractor research and development activities necessary to meet the Nation's objectives in space and aeronautics research. The civil service personnel funded by this line item represent NASA's most important resource and are the strength on which our world leadership in space and aeronautics

depends. Three-fourths of this appropriation is required for their salaries and related costs. About two percent is for travel which is vital to the management of our R&D programs. The balance is for facility support and related goods and services. Our request for fiscal year 1980 totals $964.9 million.

The austerity of the fiscal year 1980 budget, as well as the Congressional mandate in the Civil Service Reform Act for reducing Federal manpower levels in fiscal year 1979, necessitate an overall reduction of 674 in the NASA permanent civil service personnel ceiling. This reduction will be phased through fiscal years 1979 and 1980. The NASA permanent civil service manpower ceilings will be reduced to 22,831 by the end of fiscal year 1979, and 22,563 by the end of fiscal year 1980. This compares to a workforce of about 35,000 civil servants in the late 1960s.

In conclusion, I believe the President's budget request comprises a sound, balanced aeronautics and space program, given the constraints of the national anti-inflation effort. This request provides a sound foundation for meeting the stated goals of the civil space policy and will permit the United States to maintain its leadership in space science, applied technology, and aeronautics. It also fully supports the continued development of the Space Transportation System and meets commitments made in the past, maintains progress in ongoing programs, and provides for flexibility in future programs. The President's fiscal year 1980 budget request is tight, but sufficient to continue our transition to the Shuttle era in a time of fiscal stress.

Sincerely,

Robert A. Frosch

Earth Resources Tracker—This is what Landsat–D will look like as it scans the Earth from 640 kilometers high, beginning in 1981. The fourth in a series of experimental satellites designed to explore the Earth and its resources, the satellite carries advanced sensors that can discriminate area features as small as a twentieth of an acre. Landsat data maps Earth features such as water resources, mineral and petroluem deposits, and terrain characteristics.

Tailspin Tester—This modified low-wing, single-engine airplane is used at the Langley center to determine effects of tail design on spin characteristics. On the basis of extensive spin-tunnel model tests, four separate tail configurations have been designed and fabricated at Langley under the general aviation stall-spin program. They are the subjects of testing, as are effects of changes in loading and mass distribution in the wings and fuselage. Because the aircraft sometimes goes into unrecoverable spins, a spin recovery parachute designed and built at Langley is fitted to the planes. Flight testing takes place at the Wallops center.

New Satellite to Examine Earth's Stratosphere

A 147-kilogram applications spacecraft was launched Feb. 18 from Wallops Flight Center by a four-stage Scout launch vehicle. Called SAGE, for Stratospheric Aerosol and Gas Experiment, the satellite will obtain data on the aerosols and ozone in the atmosphere.

Findings of the international SAGE mission will be checked against extensive "ground truth" measurements conducted by special teams in the U.S., Japan and Europe.

Worldwide concern has developed in recent years over the environmental quality of the stratosphere, that region of the Earth's atmosphere beginning above cloud tops at about 12 kilometers and extending to approximately 50 km. The stratosphere is a very fragile and important portion of the Earth's environment; its ozone, for example, is known to protect the Earth and its inhabitants from much of the Sun's ultraviolet radiation.

The stratosphere also contains a layer of dust-like particles, or aerosols, that are concentrated below the ozone peak. Aerosols, small solid particles or liquid droplets suspended in the surrounding air, are typically less than one millionth of a meter in diameter. The aerosol layer acts somewhat like a filter by reducing the amount of sunlight that reaches the Earth's surface and the amount of reflected sunlight that eventually escapes into space. Small changes in aerosol concentration may cause changes in climate with important implications for agriculture, among other things.

Concerns have developed that man's industrial and technological activities on and above the Earth may lead to aerosol and gas buildup in the stratosphere, causing unknown and possibly adverse affects to life on Earth.

Not only are man-made compounds injected directly into the stratosphere, aerosols and gases are generated in the troposphere (starting at the Earth's surface and extending to the stratosphere) by poorly understood processes.

The main objective of SAGE is to obtain and use global data on stratospheric aerosols and ozone in various studies concerning the Earth's climate and environmental quality. The mission is designed to obtain these data from tropical to high latitudes for at least one year.

Comparable aerosol data for the polar regions is being obtained by a stratospheric aerosol measurement experiment on the Nimbus-7 satellite, launched Oct. 24, 1978. The information will complement the SAGE data base.

The SAGE experiment aboard the Applications Explorer Mission-B spacecraft will obtain its information by means of a photometric device. Flying at a 600-km altitude in a circular Earth orbit, the SAGE photometer "looks" at the Sun through the stratosphere's gases and aerosols each time the satellite enters and leaves the Earth's shadow. The device will "see" approximately 15 sunrises and 15 sunsets each 24-hour day. The photometer records the light in four color bands, as it fades in a sunset and brightens in a sunrise. This information is converted to define concentrations of the atmospheric constituents, namely ozone and aerosols.

According to the SAGE experiment scientist, Dr. M. Patrick McCormick of NASA's Langley Research Center, the satellite's ozone measurements when combined with others will help confirm or negate the predicted chlorofluormethane effect on ozone depletion. If releases of CFM into the atmosphere were to continue at the 1975 rate theories predict

that 8 to 30 percent of the global ozone eventually would be destroyed. The greatest relative reduction would occur between 35 to 45 km. The region in question will be measured with 1 km vertical resolution and high accuracy by SAGE.

The aerosol population in the stratosphere, on the other hand, is changed abruptly by large volcanic eruptions which spew particles and gases into this region creating optical effects (prolonged and colorful sunsets, for instance) and possible cooling at the Earth's surface. Because trends in environmental quality or climate are usually masked by daily and seasonal variations, it takes a very long period of time to delineate them, McCormick says. Thus, a volcanic eruption that could be measured by SAGE would provide a singular opportunity for scientists to study the long-term distribution throughout the stratosphere of high-volume aerosols and other gases from a single source.

The NASA headquarters environmental observations program has overall responsibility for the AEM/SAGE program. The Goddard Space Flight Center is responsible for project management of the spacecraft, scientific planning and coordination, and the tracking and data acquisition system. The Langley center is responsible for the instrument module systems and the Scout launch vehicle. The Wallops center is responsible for the launching and launch support.

Boeing Aerospace Co., Seattle, a division of the Boeing Co., built the spacecraft. Ball Aerospace Division, Ball Corp., Boulder, Colo., built the SAGE radiometer under contracts administered by Goddard and Langley. Vought Corp., Dallas, a subsidiary of LTV Corp., built the Scout launch vehicle.

Electrical Problems in Space to Be Studied

Potential remedies for the negative effects of electrical static discharges on high-altitude satellites will be studied from an Air Force satellite launched by NASA from Cape Canaveral on Jan. 30.

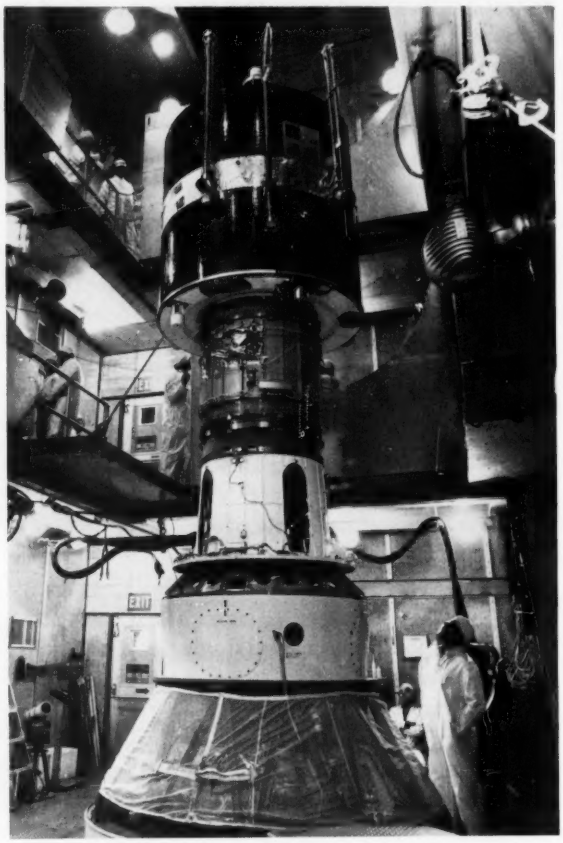
Named SCATHA (for Spacecraft Charging at High Altitudes), the 659-kilogram satellite lifted off atop a Delta launch vehicle. The Air Force is reimbursing NASA $8.9 million for the launch vehicle and services.

Most space-related electrical charging problems have been observed on satellites at the geosynchronous orbital altitude of 35,900 kilometers. Satellites in that orbit remain over the same spot on the Earth's equator because their velocity is synchronized with the Earth's 24-hour period of rotation.

Electrical arcing in commercial and military communications satellites at the geosynchronous altitude is known to have been the cause of equipment failures. Such arcing also has activated switches, resulting in false reports of an event, or reporting something as having happened when it didn't.

The orbit selected for SCATHA experiments will carry the research satellite above and below the geosynchronous orbital altitude, as well as north and south of the equatorial plane. It also will allow the vehicle to drift eastward around the globe about six degrees a day. The high and low points of the elliptical SCATHA orbit result in a movement resembling a figure eight pattern in space.

SCATHA carries 12 experiments designed to identify and measure sources of electrical charge buildup on the spacecraft. They also will measure the



Almost Ready for Space—SCATHA is enclosed in a nose fairing atop Delta 148 at the Kennedy Space Center.

electrical charging levels and rates of some 20 metals and insulation devices, including types previously used and some new ones.

Three SCATHA experiments are provided by NASA, including a mass spectrometer from the Marshall center. The Goddard center experiments consist of a precise magnetometer and an electric field detector.

Project engineers will keep a close watch on the deployment of Goddard's electric field detector because of its possible effect on the dynamics of the satellite. That unit consists of two 50-meter-long antennas extended in opposite directions to form a single line antenna longer than a football field.

The electric field detector antenna will be deployed to its full length in mid-March, just ahead of a period of daily eclipses of the Sun by the Earth to be encountered by SCATHA. Most serious electrical charging events on spacecraft have happened during such periods of eclipse. Sunlight reduces the electrical-charging phenomena. The spring eclipse period for the satellite begins March 20 and lasts about 44 days. The maximum period of any daily eclipse for the orbiting spacecraft will be 71 minutes. Another eclipse period will occur next fall.

In addition to their direct effect on the design of satellites operating at the geosynchronous orbit, data from the SCATHA program may be vital to NASA's long-range plans for large-scale satellite structures. Fabrication in space from orbiting spacecraft is one of the possibilities envisioned for the 21st century. The need to operate such spacecraft at high power levels requires a better understanding of the effects of electrical charges.

Other sponsors of SCATHA experiments are the Air Force Space and Missile Systems Organization, the Air Force Geophysics Lab, and the Office of Naval Research. The satellite was developed by the Martin Marietta Aerospace Corp. of Denver, Colorado.

The Delta launch vehicle program is managed by the Goddard center for NASA's Office of Space Transportation Systems. The Kennedy Space Center manages launch operations. Prime contractor for the Delta and for launch operations is McDonnell Douglas Astronautics Co. of Huntington Beach, Calif.

Worldwide Cooperative Study of Weather Begun

The largest international scientific experiment ever conducted began in January. The Global Weather Experiment uses the services of thousands of scientists from many nations. Joined in the effort are scientists from NASA's Goddard Space Flight Center. The experiment seeks to gauge the practical limits of weather forecasting and design a world weather observing system to achieve them.

During the 12-month venture, a massive array of scientific personnel and observing equipment will be monitoring the Earth's oceans and atmosphere to build the most complete record of global weather data ever assembled.

The experiment is part of the Global Atmospheric Research Program, a joint effort of the World Meteorological Organization and the International Council of Scientific Unions. All 147 member nations of the WMO are involved in some way, and 70 countries and five international organizations are contributing directly. United States participants include the Departments of Commerce, Defense, Energy, Interior, Transportation, and State; NASA; the National Center for Atmospheric Research; the National Science Foundation; the Defense Nuclear Agency; the Air Force, Army, Navy, and Coast Guard; and many academic institutions. Scientific advice for the program and liaison with the international scientific community are provided by the National Academy of Sciences. U.S. participation is coordinated by the National Oceanic and Atmospheric Administration.

The scope of the operation is vast. The existing World Weather Watch, which generates upwards of 40,000 observations daily, is being supplemented by 10 space satellites, some 50 research vessels, 110 aircraft (including 10 research planes), 300 high-altitude balloons, and 300 instrumented drifting buoys.

New generation satellites are playing a central role in the experiment. Five satellites in geosynchronous orbit, three from the U.S. (GOES), one from Japan (GMS), and one from the European Space Agency (Meteostat), are hovering 36,000 kilometers above the equator. The polar-orbiting Tiros-N is a primary source of data, and NOAA-A—scheduled for launch in May—will be an added contributor of space information. Two more polar-orbiting satellites from the U.S.S.R. also are slated to participate. All

spacecraft are or will be monitoring winds (from cloud images), atmospheric temperature, and humidity. The polar-orbiting Nimbus-7 supplies additional information on factors such as ocean rainfall and sea surface temperatures.

The focus of the NASA studies is on the application of satellite data to the forecasting problem and the design of the best possible meteorological space system for the future. The research is being done at the Goddard center's Laboratory for Atmospheric Sciences through its GARP project, which is managed by James R. Greaves.

Total cost of the grand experiment to the U.S. is $90 million, which figure includes all costs for all U.S. agencies involved for the 10-year period from 1974 to 1984 (The Global Weather Experiment actually began in 1974 with the GARP Atlantic Tropical Experiment in which the Earth's tropical belt from Mexico to East Africa was surveyed.) NASA's share of that cost is $25 million.

An important part of the research is the broad belt around the equator, the enormous heat sink that absorbs much of the Sun's energy and generates much of the world's weather. To get more data on this lightly observed (at present) but crucial region, a number of special observing systems are being operated during two "special observing periods"—Jan. 5 to March 5 and May 1 to June 30—during which periods vital information on tropical winds will be gathered.

Some 50 ships (mainly oceanographic research vessels) from 22 nations will twice daily release balloon-borne instrument packages called "radiosondes." Ten U.S. Air Force and NOAA aircraft will fly daily sorties, dropping wind-measuring instruments over the equatorial Atlantic, the central and eastern Pacific, and the Indian Ocean. U.S. researchers will launch 150 constant-level balloons from Ascension Island in the Atlantic and Canton Island in the Pacific to monitor winds at 14,000 meters.

Virtually no weather observations now come from the lonely ocean expanses of the southern hemisphere. The U.S. polar-orbiting satellites help fill this data void. But to get more detailed measurements, some 300 instrumented buoys (from eight nations) have been deployed over an area 20 to 60 degrees south latitude. These drifting buoys provide sea-surface temperatures and atmospheric pressure measurements.

During all of 1979, 20 specially-equipped, wide-bodied commercial jets on international routes will automatically transmit wind, temperature and

A Skyful of Technology—This is a fanciful drawing of the many kinds of vehicles and instruments to be used in the 1979 international study of world weather.

pressure data to satellite receivers. Another 80 or so commercial jets will be supplying this same sort of information on a delayed basis.

All these systems will generate weather data for the 85 percent of the Earth's area not now covered by the World Weather Watch. Because weather in the equatorial belt and the southern hemisphere has a powerful influence on conditions to the north, such information is necessary for extended forecasting.

Once the Global Weather Experiment ends on Nov. 30, 1979, the mass of data first will be processed by centers in a number of nations and then forwarded to World Data Centers in Moscow and Washington, D.C. and to meteorological research laboratories in Bracknell, England, and Princeton, N.J. There scientists will use giant computers to refine the data and for the first time construct a complete 12-month world weather history. Researchers then will be able to run computer experiments that use this unique record to test results. The outcome of these experiments should enable scientists not only to determine the ultimate limits of weather prediction, but also what weather data are necessary to reach those limits, and what kind of global observing system is needed to gather such data.

Probably several years will be needed for the production of answers, but the results could be far-reaching. The potential socio-economic impact of improved extended weather forecasts could be dramatic. Many industries—construction, agriculture, transportation, energy, and others—would benefit enormously from a better knowledge of what the weather would be as far as a week or two, perhaps even three weeks in advance.

Education Centerpiece

One of NASA's recent and most useful acquisitions is the Management Education Center, refurbished in 1976 for NASA usage at the Wallops Space Flight Center. The education center consists of three buildings—one for conferences and study, the second a residential facility, the third housing dining facilities—situated close by picturesque farm and fishing communities near the ocean on the Virginia eastern shore. Before NASA took them over, the buildings had been used by Navy personnel as a barracks, a conference center, and a cafeteria.

The MEC, the focal point for agency management education programs, is a unit of the headquarters professional development branch, headed by acting chief Louis B. DeAngelis.

One of the buildings in the three-unit Management Education Center.

The center represents NASA's commitment to the creation of unique agency-wide education opportunities for its middle and top management people. At this time a number of educational sessions are held yearly for these NASA managers. The major effort, entitled "Middle Management Education Program" or MEP, brings together mid-level managers from all NASA centers and headquarters for an intensive, two-week, live-in study session at the center.

NASA has designed the program as a means of educating present and future agency leaders. Course sessions are scheduled in the daytime and at night as well as on weekends—what might be called a "cram course" in NASA's managerial patterns.

During the most recent session, 29 people gathered at the center, reporting from the nine NASA field installations and from D.C. headquarters, to participate in discussions and lectures centered on:

1. their style and methods of managing
2. improving managerial knowledge and skills
3. examining their roles in the changing NASA environment
4. broadening their understanding of NASA as a system of interdependent programs, offices and centers.

As is true of all who attend the study sessions, attendees worked and studied with key administrators, directors, management specialists, the MEC staff, and each other for two weeks.

Topics within the first heading (above) covered: communications—organizational and interpersonal; management of time, people, money, productivity, conflict, agreement, meetings, work planning; leadership and motivation; and influence and decision-making.

Under the second heading, subjects were: NASA in perspective—historical view; NASA in transition—present and future; managing the future of NASA; managing within a research and development environment; the individual manager in a changing NASA environment; and ethical issues in government management.

Under the next two headings, the relations between mid-level managers and NASA programs and offices were explored by discussions of: the contents, development and planning of programs; NASA's external environment, including public relations, international relations and congressional relations; management operations; resource management—budget, personnel, equal opportunity; contract management—procurement and labor relations; and special issues in center management.

To get the message across, MEC managers use different educational techniques including small group exercises, case studies, formal presentations and team projects. NASA officials, including the Administrator and Deputy Administrator, regularly attend sessions.

Nominees for attendance at center programs must be practicing managers at the division level in field installations. Headquarters nominees must be at office or division director or program manager level. Both must be mid-level managers representing different functional areas within their organization.

Other NASA programs held regularly at the center consist of the six-day, live-in "Project Management Shared Experience" for new project managers, deputy project managers and project sub-system managers; and the three- to five-day "NASA Senior Management Program," for field center and headquarters senior managers in policy-making jobs.

The center itself is a model of comfort and convenience. Private single rooms which are assigned to participants contain a bed, desk, chairs, four-drawer wall unit, lavatory, closet and a clock radio. Daily maid service is provided. The residence building also contains two lounge areas featuring TV, telephones, reading matter and fireplaces. A washer and a dryer are available in the building.

The next-door conference building accommodates more than 80 people in two main rooms for general sessions. A fully equipped projection room is on the premises. All rooms are air-conditioned, sound-proof and well furnished. The building has other rooms for small groups. An extensive collection of management literature is on hand in the study area. The bright and cheerful lobby often serves as a social center.

Three meals a day are served a block away in the dining building, either buffet style or sit-down dinners in the elegant colonial dining room. Individual centers pay a $3.50 per diem rate for lodgers.

Beautiful farming and fishing country surrounds the education center.

Administrator Dr. Robert A. Frosch congratulates Clarence Brown of the Lewis center, one of the NASA participants in a study session.

Available to visitors—*if* they can spare the time—are facilities for cycling, jogging, handball, volleyball, basketball and tennis, and the nearby Atlantic shore invites beach walks and fishing. Local transportation is available as are medical services at the main Wallops center.

The facility can be rented out to other federal, state and county agencies, with rental fees covering all services. Outside agencies pay for their own catering and for any extra help they may require.

In charge of arrangements for conferences is Christopher Floyd, chief of management services at the Wallops Flight Center.

HEAO 1 Mission Ends

NASA's first High Energy Astronomy Observatory (HEAO 1) exhausted its supply of attitude control gas in January, ending a 17-month mission to survey and map X-ray sources throughout the sky. Although HEAO 1 was designed for only a six-month lifetime (the length of time required to survey the entire sky), the quality of data returned was so excellent that extensions subsequently were authorized.

The spacecraft was the first of a three-mission program to study pulsars, quasars, exploding galaxies and black holes in space. The second observatory, HEAO 2, was launched Nov. 13, 1978, and the third one is scheduled for launch this coming September. The HEAO project is managed by NASA's Marshall Space Flight Center.

Since successfully completing its primary mission in February 1978, HEAO 1 has continued to sweep the skies, reaping a rich scientific harvest of detailed X-ray data of unprecedented accuracy, NASA scientists reported. All experiments have continued to function during the extended mission and spacecraft systems have fully supported all scientific operations. Besides mapping the X-ray sky, the satellite has pointed at and studied more than 300 stellar sources of particular interest. It also has measured low-energy gamma-ray flux.

Although analysis of HEAO 1 data will require years of work by the astrophysicists who study high-energy phenomena, more than 160 technical papers and scientific presentations already have been given on HEAO 1 results. Scientists believe that this important new knowledge may bring fundamental changes in concepts of the universe.

Three results from HEAO 1 to date are that:

- The catalog of celestial X-ray sources has been increased by HEAO 1 from the 350 previously known to a total of nearly 1,500.
- A new black hole possibility was located near the Constellation Scorpius, bringing the total to four. (A black hole is a massive star that has collapsed on itself to a density so great that not even light can escape.)
- A universal hot plasma constituting a major fraction of the mass of the universe was discovered, as well as a cloud of dust and gas with a mass equal to a million billion Suns enveloping a super-cluster of galaxies. The discovery suggests sufficient mass exists to "close" the universe (i.e., preclude its expanding forever).

HEAO 1, which weighs 2,566 kilograms, has been orbiting the Earth at an altitude of approximately 444 kilometers. Rotating slowly end-over-end, with one revolution about every 30 minutes, the satellite used a gas thrust reaction control system to maintain proper skyscanning orientation so that the solar arrays faced the Sun at all times to provide needed electrical power.

The spacecraft is expected to reenter and burn up in the Earth's atmosphere in late March.

Skylab Attitude Change Made

On Jan. 25, the Skylab space station was maneuvered into an attitude that may allow some small measure of control over the vehicle's reentry into Earth's atmosphere. Since June 1978, engineers at the Marshall Space Flight Center and controllers at the Johnson Space Center have been maintaining Skylab in an attitude of least atmospheric drag, attempting to keep it in space until a reboost or deorbit attempt could be made by the Space Shuttle.

When NASA decided in December to abandon that attempt, engineers began looking at the vehicle in a different way. The new solar inertial attitude positions the solar panels to constantly point toward the Sun, assuring full electrical power at all times and thus preserving the possibility of some minimal influence at final reentry.

Views differ as to the feasibility of useful control over the spacecraft's final reentry but it was deemed desirable to preserve the option while studies continued.

NASA Budget Plan for Fiscal Year 1980

(Figures submitted to the Congress)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

BUDGET SUMMARY
(Thousands of Dollars)

BUDGET PLAN	FY 1978	FY 1979	FY 1980
Research and development	3,011,600	3,477,200[a]	3,602,500
Construction of facilities	162,340	147,500	157,600
Research and program management	889,506	941,469[b]	964,900
TOTAL BUDGET PLAN	4,063,446	4,566,169	4,725,000
OUTLAYS	3,983,119	4,404,100	4,595,000

a/ Includes proposed supplemental of $185,000,000 for the Space Shuttle.

b/ Includes proposed supplemental of $30,969,000 for October 1978 pay increase.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND DEVELOPMENT PROGRAMS

BUDGET PLAN
(Thousands of Dollars)

Cognizant Office and Program	FY 1978	FY 1979	FY 1980
SPACE TRANSPORTATION SYSTEMS	1,751,500	2,009,500	1,904,000
Space shuttle	1,349,200	1,628,300[a]	1,366,000
Space flight operations	267,800	309,700	467,300
Expendable launch vehicles	134,500	71,500	70,700
SPACE SCIENCES	404,700	505,400	601,600
Physics and astronomy	224,200	282,900	337,500
Planetary exploration	147,200	182,400	220,200
Life sciences	33,300	40,100	43,900
SPACE AND TERRESTRIAL APPLICATIONS	243,900	283,900	344,400
Space applications	234,800	274,800	332,300
Technology utilization	9,100	9,100	12,100
AERONAUTICS AND SPACE TECHNOLOGY	333,200	376,400	419,700
Aeronautical research and technology	228,000	264,100	300,300
Space research and technology	97,700	107,300	116,400
Energy technology	7,500	5,000	3,000
SPACE TRACKING AND DATA SYSTEMS	278,300	302,000	332,800
TOTAL	3,011,600	3,477,200	3,602,500

a/Includes proposed supplemental of $185,000,000.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE TRANSPORTATION SYSTEMS

BUDGET PLAN
(Thousands of Dollars)

	FY 1978	FY 1979	FY 1980
SPACE SHUTTLE	1,349,200	1,628,300[a]	1,366,000
Design, development, test and evaluation	(1,307,500)	(1,170,300)	(610,500)
Orbiter	813,060	654,900	283,400
Main engine	197,400	161,400	110,600
External tanks	88,030	107,600	59,800
Solid rocket boosters	104,998	100,200	57,500
Launch and landing	104,012	146,200	99,200
Production	(41,700)	(458,000)	(755,500)
Orbiter	29,140	344,100	590,600
Main engine	12,560	81,300	80,300
Launch and landing	—	12,400	24,600
Spares and equipment	—	20,200	60,000
SPACE FLIGHT OPERATIONS	267,800	309,700	467,300
Space transportation system operations capability development	69,400	109,300	128,600
Development, test and mission support	171,900	160,000	172,600
Space transportation system operations	16,500	33,400	153,100
Advanced programs	10,000	7,000	13,000
EXPENDABLE LAUNCH VEHICLES	134,500	71,500	70,700
Scout	16,300	11,400	7,300
Centaur	41,500	21,500	18,300
Delta	70,400	38,600	43,100
Atlas-F	6,300	—	2,000
TOTAL SPACE TRANSPORTATION SYSTEMS	1,751,500	2,009,500	1,904,000

a/Includes proposed supplemental of $185,000,000.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SCIENCE

BUDGET PLAN
(Thousands of Dollars)

	FY 1978	FY 1979	FY 1980
PHYSICS AND ASTRONOMY	224,200	282,900	337,500
High energy astronomy observatories development	19,811	11,100	4,800
Solar maximum mission development	29,600	16,200	600
Space telescope development	36,000	79,200	112,700
International solar polar mission development	--	13,000	50,000
Shuttle/Spacelab payload development	27,061	34,900	41,300
Explorer development	24,297	29,800	30,400
Mission operations and data analysis	19,298	25,000	36,500
Research and analysis	42,934	44,400	34,300
Suborbital programs	25,199	29,300	26,900
PLANETARY EXPLORATION	147,200	182,400	220,200
Pioneer Venus	17,900	—	—
Galileo	20,950	78,700	116,100
Mission operations and data analysis	64,359	59,300	59,000
Research and analysis	43,991	44,400	45,100
LIFE SCIENCES	33,300	40,100	43,900
Life sciences flight experiments	9,000	11,900	12,900
Vestibular function research	1,500	3,800	3,700
Research and analysis	22,800	24,400	27,300
TOTAL SPACE SCIENCE	404,700	505,400	601,600

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE AND TERRESTRIAL APPLICATIONS

BUDGET PLAN
(Thousands of Dollars)

	FY 1978	FY 1979	FY 1980
SPACE APPLICATIONS:	234,800	274,800	332,300
RESOURCE OBSERVATIONS	(102,845)	(139,150)	(141,400)
Landsat-3	3,155	700	--
Landsat-D	48,200	97,500	89,800
Heat capacity mapping mission	600	300	--
Magnetic field satellite	10,500	3,900	1,600
Shuttle/Spacelab payload development	3,620	6,000	1,600
Applied research and data analysis and related activities	36,770	30,750	48,400
ENVIRONMENTAL OBSERVATIONS	(75,415)	(67,900)	(117,200)
Tiros-N	4,100	1,200	--
Nimbus-7	12,210	3,624	500
Seasat	14,367	3,500	--
Earth radiation budget experiment	--	7,000	23,000
Halogen occulation experiment	--	3,600	8,000
Stratosphere aerosol and gas experiment	2,400	--	--
Shuttle/Spacelab payload development	6,040	7,750	7,400
Applied research and data analysis and related activities	36,298	41,226	78,300
APPLICATIONS SYSTEMS	(13,340)	(15,700)	(24,200)
TECHNOLOGY TRANSFER	(10,400)	(10,950)	(10,300)
MATERIALS PROCESSING IN SPACE	(13,650)	(20,400)	(19,800)
Space processing applications rocket project	3,900	3,600	2,100
Applied research and data analysis	4,350	4,400	6,900
Shuttle/Spacelab payload development	5,400	12,400	10,800
SPACE COMMUNICATIONS	(19,150)	(20,700)	(19,400)
Search and rescue mission	5,600	8,000	5,000
Shuttle/Spacelab payload development	1,000	1,200	1,400
Applied research and data analysis and related activities	12,550	11,500	13,000
TECHNOLOGY UTILIZATION	9,100	9,100	12,100
TOTAL SPACE AND TERRESTRIAL APPLICATIONS	283,900	283,900	344,400

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1980 CONSTRUCTION OF FACILITIES PROGRAM

BUDGET PLAN
(Thousands of Dollars)

PROJECTS BY INSTALLATION

Ames Research Center	2,900
Modification of Static Test Facility (N-249)	2,900
Hugh L. Dryden Flight Research Center	1,500
Construction of Large Aircraft Maintenance Dock	1,500
Lyndon B. Johnson Space Center	1,760
Rehabilitation and Modification of Flight Operations Facilities, Ellington AFB	1,760
John F. Kennedy Space Center	2,210
Modifications to the Central Instrumentation Facility	1,260
Modifications to the Operations and Checkout Building	950
Langley Research Center	7,980
Modifications of Model Support System 8-Foot High Temperature Structures Tunnel (1265)	1,410
Modifications to 8-Foot Transonic Pressure Tunnel (640)	2,000
Modification of Transonic Dynamics Tunnel (648)	970
Rehabilitation and Modification of Gas Dynamics Laboratory (1247)	3,600
Lewis Research Center	5,720
Modifications to Central Air System, Various Buildings	5,720
George C. Marshall Space Flight Center	3,540
Modifications to Various Buildings	2,640
Rehabilitation of Roofs, Various Buildings	900
Wallops Flight Center	1,100
Construction of Facilities Operations Shop Building	1,100

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AERONAUTICS AND SPACE TECHNOLOGY

BUDGET PLAN
(Thousands of Dollars)

	FY 1978	FY 1979	FY 1980
AERONAUTICAL RESEARCH AND TECHNOLOGY	228,000	264,100	300,300
Research and technology base	97,805	109,200	117,500
Systems studies	3,000	3,000	3,200
Systems technology programs	75,765	85,645	106,100
Experimental programs	51,430	66,255	73,500
(Aircraft energy efficiency technology included in systems technology and experimental programs)	(70,200)	(97,400)	(116,100)
SPACE RESEARCH AND TECHNOLOGY	97,700	107,300	116,400
Research and technology base	65,505	71,795	77,100
Systems studies	2,000	2,000	2,200
Systems technology programs	5,800	7,900	16,000
Experimental programs	15,395	16,605	18,100
Standards and practices	9,000	9,000	3,000
ENERGY TECHNOLOGY	7,500	5,000	3,000
TOTAL AERONAUTICS AND SPACE TECHNOLOGY	333,200	376,400	419,700

SPACE TRACKING AND DATA SYSTEMS

	FY 1978	FY 1979	FY 1980
TRACKING AND DATA ACQUISITION	278,300	302,000	332,800
Operations	228,584	251,600	275,800
Systems implementation	40,400	40,500	46,400
Advanced systems	9,316	9,900	10,600

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1980 CONSTRUCTION OF FACILITIES PROGRAM

BUDGET PLAN
(Thousands of Dollars)

PROJECTS BY INSTALLATION

Large Aeronautical Facilities at Various Locations	45,900
Construction of National Transonic Facility (LaRC)	12,000
Modification of 40- by 80-Foot Subsonic Wind Tunnel (ARC)	33,900
Space Shuttle Facilities at Various Locations	31,450
Modifications to Launch Complex 39 (KSC)	17,700
Modifications to Crawler Transporter Maintenance Facility (KSC)	1,250
Modification of Manufacturing and Final Assembly Facilities for External Tanks (MAF)	10,000
Minor Shuttle-Unique Projects (Various Locations)	2,500
Space Shuttle Payloads Facilities at Various Locations	4,250
Rehabilitation and Modification for Payload Ground Support Operations (KSC)	2,610
Modification of and Addition to Materials Sciences Laboratory (N240) (ARC)	1,640
Repair of Facilities at Various Locations not in Excess of $500,000 per Project	12,000
Rehabilitation and Modification of Facilities at Various Locations, Not in Excess of $500,000 per Project	19,790
Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in Excess of $250,000 per Project	3,500
Facility Planning and Design	14,000
TOTAL	157,600

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND PROGRAM MANAGEMENT

BUDGET PLAN
(Thousands of Dollars)

INSTALLATION	FY 1978	FY 1979	FY 1980
Johnson Space Center	146,654	154,163	156,466
Kennedy Space Center, NASA	113,765	120,907	128,149
Marshall Space Flight Center	143,445	148,276	148,884
National Space Technology Laboratories	2,732	4,527	4,689
Goddard Space Flight Center	123,853	128,230	131,197
Wallops Flight Center	15,020	15,493	16,330
Ames Research Center	57,730	63,761	65,839
Dryden Flight Research Center	18,247	19,557	19,791
Langley Research Center	102,019	107,996	110,258
Lewis Research Center	84,916	92,513	95,800
NASA Headquarters	81,125	86,046	87,497
TOTAL	889,506	941,469[a/]	964,900

a/ Includes proposed supplemental of $30,969,000 for October 1978 increased salary rates.

TOTAL NUMBER OF PERMANENT POSITIONS - END OF YEAR

Johnson Space Center	3,532	3,509	3,445
Kennedy Space Center	2,179	2,193	2,187
Marshall Space Flight Center	3,760	3,636	3,561
National Space Technology Laboratories	102	104	103
Goddard Space Flight Center	3,575	3,468	3,440
Wallops Flight Center	407	398	395
Ames Research Center	1,669	1,666	1,653
Dryden Flight Research Center	490	480	461
Langley Research Center	3,071	3,015	2,990
Lewis Research Center	2,921	2,858	2,835
NASA Headquarters	1,531	1,504	1,493
TOTAL	23,237	22,831	22,563

New Computer Facility

Ground was broken in January at the Lewis Research Center for what will be one of the leading computer centers in the country for analysis of aeronautical propulsion concepts and designs. To be known as the Research Analysis Center on completion in 1980, the installation will be the first major addition to research facilities at Lewis in over a decade.

"In practical terms, we are going to use sophisticated computer technology instead of laborious and expensive hardware testing wherever possible to advance aircraft engine development and in appropriate other research and technology projects," said Lewis director Dr. John F. McCarthy, Jr. "By so doing, we should be able to considerably reduce time and costs associated with many of our major programs and be able to amortize the new facility in a relatively short period."

The new research center recovers heat from the operating computer equipment and stores it in a 70,000-gallon holding tank for use elsewhere in the facility. Another energy-conserving measure consists of high-pressure sodium lighting fixtures that greatly reduce consumption of electricity. They are designed with 50 to 60 percent less window area in external walls than is customary in conventional construction.

Lewis facility engineers say the new structure will be the first NASA facility anywhere to meet all present and proposed national energy standards. It will be located on a presently vacant parcel of land near the main complex of research buildings.

Other design highlights:

- 5,980 square meters of space will be used for the structure.
- An integrated building design will be employed, incorporating an L-shaped, two-story office building surrounding on two sides a spacious, one-story computer operations center.
- Special steel frame construction will be used for the computer building to provide for close control of temperature, humidity and other environmental factors.

Some 180 employees will work in the analysis center, transferring from scattered facilities on the base which presently provide computer services. The new building, in effect, will consolidate and greatly expand and improve these services, Lewis officials said.

Estimated cost of the new center will be approximately $6 million for construction and $7.4 million for new equipment. The latter will include a state-of-the-art computer system to replace a presently outmoded and limited-capacity computer that has been in service at Lewis for more than 10 years. Much of the base's existing computer equipment will be retained and reused.

Lewis officials foresee a need by the end of 1981 for installation of a large, new computer to further

assist and amplify NASA research efforts here. The "bigger number cruncher" would be able to interact with NASA field centers all over the country and with other public and private research and development facilities as needed. The new analysis center would easily accommodate such a scaled-up system.

"The new computer center will offer one of the top capabilities anywhere for analytical work in internal aerodynamics. Moreover, it will have the potential to impact and serve NASA needs across the nation as well as interests of the scientific community at large, including some of our larger universities," McCarthy said in his first public speech since assuming directorship of the center.

McCarthy has been director of the Lewis Center since October 1978. Previously he was director of the Massachusetts Institute of Technology's Center for Space Research. From 1971 to 1974 he was professor of aeronautics and astronautics at M.I.T.

McCarthy came to M.I.T. from the Los Angeles division, North American Rockwell Corp. where he was vice president, systems engineering. Before that, he held a number of executive jobs with the company. At one time, he was involved with the basic design and testing of the Apollo command and service modules and the S-II stage of the Saturn V launch vehicle.

From 1971 to 1978, McCarthy chaired the Aeronautical Systems Division Advisory Group of the Air Force Systems Command. In 1973 he was awarded the Meritorious Civilian Service Award by the Air Force for his work on the C-5A transport airplane.

A Bostonian, McCarthy received S.B. and S.M. degrees in aeronautical engineering from M.I.T. in 1950 and 1951, and a Ph.D. in aeronautics and physics from the California Institute of Technology in 1962. He completed the Executive Program at UCLA's Graduate School of Management in 1966.

McCarthy is the author of numerous technical papers and contributor to four textbooks, a fellow and former director of the American Institute of Aeronautics and Astronautics (AIAA), associate fellow of the Royal Aeronautical Society, and a member of Sigma Gamma Tau, Research Society of America, and Sigma Xi.

He is a member of the aerospace vehicle and strategic panels of the Air Force Scientific Advisory Board, a member of the American Management Association's President's Council, and former member of the Executive Committee of the Aerospace Division of the American Society for Engineering Education. He was a member of the NASA Research and Technology Advisory Council (panel on space vehicles) from 1974 to 1977. From 1965 to 1967, he served as a member of the NASA Research Advisory Committee on space vehicle aerodynamics. He was a consultant to the Office of the Director of Defense Research and Engineering in 1976, and he has been a member of the Joint Strategic Target Planning Staff Scientific Advisory Group for the Joint Chiefs of Staff since 1976.

Joint Ground-Breaking—Initiating work on a major computer center at the Lewis center are, left to right: Ladd Antony, representing U.S. Senator Howard M. Metzenbaum (Ohio); Dr. John F. McCarthy, Jr., director of the Lewis center; U.S. Representative Donald J. Pease (Ohio); John Lathe, president of the Cleveland Growth Association; and Pat Bluso, representing U.S. Senator John H. Glenn (Ohio).

Minority Firm Gets NASA Contract

Fletcher and Sons of Philadelphia has been awarded a $3.3 million contract by the Goddard center for construction of a technical processing facility. The first major NASA construction contract to be awarded to a minority company, it calls for Fletcher and Sons to construct a building at Goddard to be used primarily for processing data from the Landsat-D spacecraft within 18 months after groundbreaking on Jan. 24.

The Small Business Administration contributes $167,000 of the total contract price.

Solar System at Senior Center

A new system using free energy from the Sun to furnish heat and hot water for the Huntsville, Ala., Senior Citizen's Center was dedicated recently in an Open House ceremony. Dr. W. R. Lucas, director of the Marshall Space Flight Center was the keynote speaker.

In a joint project involving the city of Huntsville, the Department of Energy and the Marshall center, a solar heating and hot water system was installed at the Senior Citizen's Center. The new system furnishes heat for 1,189 square meters of space, as well as hot water used at the center.

Collectors for the solar system were especially designed for the building in a way that added to its attractiveness. The unique design, in which the collectors are tilted to give a true south orientation, is the first of its kind. The system will satisfy 85 percent of the center's heating and hot water demand and will use the existing conventional system as a backup.

Papago Indians Receive Energy Boost

The world's first solar electric village power system was dedicated recently by officials from the U.S. Department of Energy, the Papago Tribe of Arizona, the U.S. Public Health Service and NASA's Lewis Research Center.

Funded primarily by the DoE, the Schuchuli (pronounced SCHTEW-chewlik) Photovoltaic Village Power Project is managed by the Lewis center as part of DOE's National Photovoltaic Conversion Program.

"DoE's program is aimed at developing solar cell power systems which can provide a significant amount of the nation's energy requirements by the year 2000," said Robert D. Thorne, Assistant Secretary for Energy Technology at DoE. "The Schuchuli project is one of several sponsored by DOE to stimulate new markets for solar cell power through cooperative cost-shared experiments with potential users."

The new 3,500 watt (peak) solar electric power system will provide Schuchuli's 96 residents with sufficient electricity to power 15 four-cubic-foot refrigerators, a standard wringer-type washing machine, a sewing machine, a two-horsepower water pump (18,925 liters per day) for the community well, and 40 fluorescent lights for the village's 15 homes, church, feast house and new domestic services building.

The people of Schuchuli formerly relied on kerosene lamps for lighting; laundry was washed by hand or taken 53 kilometers to the nearest commercial laundry; and perishable foods and medicines could not be stored. Water for domestic use and stock watering was pumped by diesel engine which, because of cost of maintenance and fuel, was a drain on the resources of the people. The introduction of solar electric power promises to change all this.

According to Cecil Williams, Chairman of the Papago Tribal Council, "This is a first step toward meeting critical power needs for many isolated Indian villages throughout the United States."

The application of solar electric technology in the Arizona desert has worldwide implications, said Dr. Louis Rosenblum, chief of the Solar and Electrochemistry Division at Lewis.

"There are more than three million villages without electrical power in the world today, mainly in the less developed countries," notes Rosenblum. "The success of the solar cell power system here at Schuchuli could influence the direction taken by developing countries to satisfy the pressing energy needs of their large rural populations."

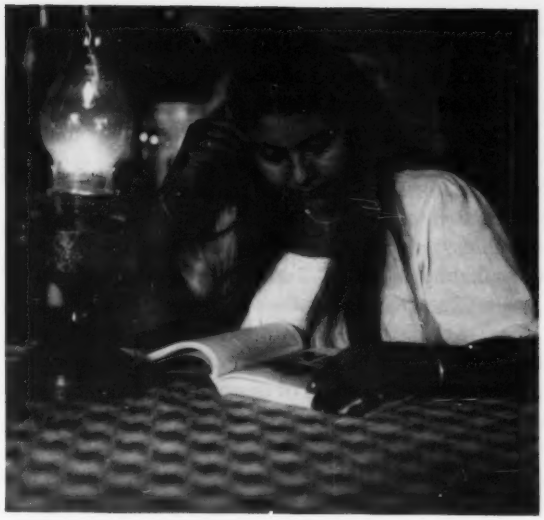
Under terms of the project's "Memorandum of Understanding," signed last spring, NASA-Lewis furnished the power system, associated electrical equipment and the technical assistance necessary for installation.

The Papago Construction Company, an arm of the Papago Tribal Council, erected the solar arrays and installed all power system equipment. Papago workmen also constructed the domestic services building, which contains the village's new solar-powered appliances, and an electrical equipment building to house the system's instrumentation, controls and storage batteries. The system's electrical distribution network of poles and lines, including all wiring exclusive of the actual power system equipment, was installed by the Papago Tribal Utility Authority.

The U.S. Public Health Service's Tucson and Sells (Ariz.) offices administered local portions of the project, coordinated the connection of mechanical equipment to the power system, installed sanitary facilities and served as a liaison between the various federal, regional and state agencies involved in the project. Other concerned government agencies included the Four Corners Regional Commission, which provided a grant of money to the tribe to help

defray costs of the domestic services building, and the Bureau of Indian Affairs, U.S. Department of Interior, which provided help in expediting contracts.

Located approximately 191 kilometers west of Tucson, Schuchuli is in the Gunsight Hills area of the western edge of the 1,214-hectare Papago Indian Reservation.



Only Yesterday—Kerosene was the fuel used for lighting in Schuchuli before the installation of the Photovoltaic Village Power Project in the Arizona village. Now each home has access to electrical power.

Brand New Source of Energy—Situated at the edge of the village, the system's solar cell array field consists of 192 photovoltaic power modules, each of which contains 42 solar cells that convert visible sunlight directly into electricity. Excess electrical energy is stored in a bank of lead acid batteries, specifically designed for solar electric usage. Power is withdrawn from the batteries for lights and appliances during the evening hours or on cloudy days, as needed.

Presidential Certificate to NASA Man

Joseph R. Beicher, manager of administrative communications at the headquarters Office of Space Tracking and Data Systems, recently was awarded a Presidential Certificate of Appreciation for his contributions toward a more effective and responsive Federal Government.

Beicher received the award for his efforts as a member of the President's Administrative Services Reorganization Project for telecommunications. The project team reviewed the acquisition, operation, and management of the federal government's telecommunications, agency by agency, the first such study in 30 years.

Upon completion of the extensive review, the project team presented to the President an extensive report on current government practices, including recommendations aimed at attaining a more responsive government.

Beicher joined NASA in 1961 as a member of the Headquarters office of Tracking and Data Acquisition.

Presidential Award to NASA Engineer

William H. Phillips, a NASA aeronautical engineer and manager, received a 1977 President's Award for Distinguished Federal Civilian Service in ceremonies held at NASA headquarters in January. Administrator Dr. Robert A. Frosch made the presentation.

Phillips, one of six recipients of the award, is chief of the flight dynamics and control division at the Langley Research Center.

The award is the highest the federal government can grant to a career employee in recognition of exceptional achievements of unusual benefit to the nation. The six winners were chosen from a group of 32 candidates.

The Phillips citation reads: "William H. Phillips: Recognized worldwide as an authority on guidance and control and flying qualities of aerospace vehicles, he has made extraordinary contributions to these and other fields of aircraft and spacecraft stability and simulation research. His achievements include theoretical and practical contributions to World War II aircraft and spacecraft, jet and supersonic aircraft, and spaceflight from its early stages through the Space Shuttle era."

Other award winners were: Ellsworth Bunker U.S. Ambassador at Large; Philip C. Habib, Under Secretary of State for Political Affairs; John R. McGuire, Chief of the Forest Service, Department of Agriculture; Stanley Sporkin, Director, Division of Enforcement, Securities and Exchange Commission; and Rosalyn S. Yalow, Senior Medical Investigator for the Veterans Administration.

Phillips, born near Liverpool, England, came to the United States with his parents when he was two years old. A graduate of Belmont, (Mass.) High School, he received his B.S. and M.S. degrees in aeronautical engineering from the Massachusetts Institute of Technology.

He began his career with NASA's predecessor agency, the National Advisory Committee for Aeronautics (NACA) in 1940, becoming a section head in 1946 and a branch chief in 1961. He was named assistant chief of Langley's aeronautics and space mechanics division in 1962 and became chief of the division in 1963. He was appointed to his present job in 1968.

Phillips has specialized in research concerning airplane stability, control and handling qualities, flight simulation, and the design of control systems for aircraft and spacecraft. He has written or cowritten more than 60 technical reports and papers and holds three U.S. patents.

A member of the Engineers Club of Virginia Peninsula, he was made a Fellow of the American Institute of Aeronautics and Astronautics in 1975. He received the AIAA's Lawrence Sperry Award in 1944 and the NASA Medal for Exceptional Scientific Achievement in 1967.

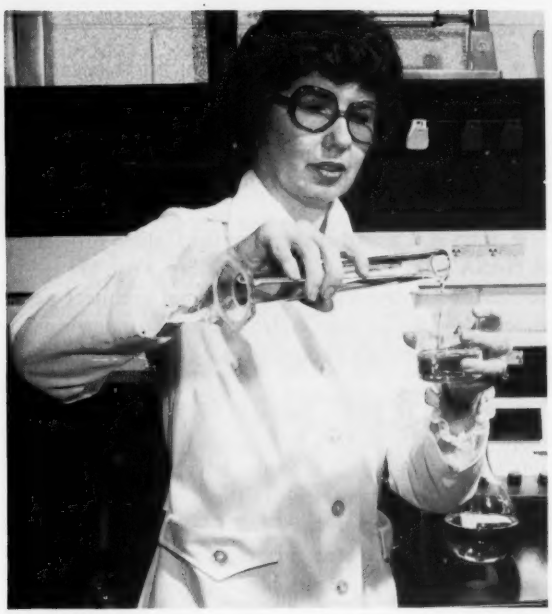
Dr. Alan M. Lovelace, Deputy Administrator (l.), Phillips, and Dr. Robert A. Frosch, Administrator.

NASA Chemist Is National Inventor of the Year

Barbara S. Askins, a chemist at the Marshall Space Flight Center, has been named the 1978 National Inventor of the Year by the Virginia-based Association for the Advancement of Inventions and Innovations. The award was presented at a ceremony held Feb. 11 at the U.S. Patent Office in Washington. The awards ceremony climaxed a two-day observance of National Inventions Day, cosponsored by the AAII and the Patent Office. The Inventor of the Year is selected from nominations received by the AAII from private business and industry as well as government agencies.

Askins was chosen because of her patented invention described as "Method of Obtaining Intensified Image from Developed Photographic Films and Plates."

Autoradiographic image intensification is a process whereby the silver or other imaging material in a



Award-winning chemist Barbara S. Askins.

developed and fixed film or plate is converted to a radioactive compound and an intensified image is obtained on a receiver emulsion which is exposed by radiation from the activated film.

The invention originally was developed to salvage data from underexposed astronomy photographs. After publication of the discovery in the Feb. 10, 1978, issue of *Science* magazine, more than 100 inquiries were received by NASA and new applications continue to be found.

In the field of medical radiography, the invention enables realization of substantially reduced X-ray dosages without loss of diagnostic quality. A study performed by scientists at Vanderbilt University with Askins demonstrated that good quality images can be obtained even when the original radiograph is underexposed 80 to 90 percent. Radiation risks to the patient in procedures such as mammography screening thus can be reduced to an extent corresponding to the dosage reduction.

The improved autoradiographic process provides a means for extracting useful information from severely underexposed photographs that would otherwise be worthless. In one instance, the invention was used to obtain good quality images from astronomical photographs exposed only 5.5 seconds instead of the scheduled 100 seconds, because of equipment malfunction in a rocket flight experiment.

Researchers in the Department of Biochemistry at Stanford University performing DNA research now report that radioactive cultures requiring months of exposure time can be completed in a few weeks by using the Askins process. Other researchers report that this technique has applications in certain types of cancer research.

Askins, a native of Belfast, Tenn., received her bachelor's and master's degrees in chemistry from the University of Alabama at Huntsville. Her husband, Robert E. Askins, a chemist and inventor, also has three patents to his credit.

Johnson Employee Invention Aids Shuttle Operation

The life of electric fuel cells on the Space Shuttle has increased from 700 to 5,000 hours as a result of an invention by Hoyt McBryar, an electrochemist at the Johnson Space Center. The invention contributes to the reusability of the Space Shuttle.

It reprocesses absestos so fibers are distributed evenly, making the material uniformly strong. The asbestos matrix contains the electrolyte for conversion of chemical energy into electricity in Space Shuttle fuel cells.

"We used ordinary kitchen equipment to do it," McBryar said, describing his work, done in 1972, when fuel cell life was short due to weak spots in the electrolyte holder. He and fellow lab workers tore sheets of asbestos into one-inch squares and put them in a kitchen blender with alcohol. They poured the resulting "slurry" through a filter box. The product was a mat of asbestos fibers at random orientation, which they dried and trimmed and put to work as an electrolyte holder.

In December 1978, NASA's Inventions and Contributions Board awarded McBryar $2,500 for the invention. The board originally recognized McBryar's contribution in 1973. Since then, Rockwell International has selected an electrical power system for the Space Shuttle orbiter that uses McBryar's asbestos-structured electrolyte holder.

McBryar, a 20-year NASA employee, was raised in Chattanooga, Tenn. He received his B.S. in 1959 and M.S. in 1961, both in chemistry from the University of Georgia.

New Director for Government/Industry Affairs

Ronald J. Philips recently was appointed director of government/industry affairs division, Office of External Relations. He will be responsible for the management and coordination of NASA's relations with government organizations other than the DoD and with industry.

Philips was with NASA from 1964 to 1971. In 1971 he helped to establish Public Technology, Inc., a company designed to match the needs of local and state governments with available sources of funding, information, and technology to meet those needs. As senior vice president of the firm, Philips was responsible for corporate planning, marketing, fiscal and program management, and direction of technical personnel.

He joined NASA at the Johnson Space Center (then the Manned Spacecraft Center) in 1964. He came to headquarters in 1966, to serve as a principal staff assistant to Administrator James E. Webb. He also served as executive assistant to Harold B. Finger, (then Associate Administrator for Organization and Management), and from 1968 until his departure, was director, office of technology utilization.

Philips received the Meritorious Award in Public Administration, presented by the William A. Pump Memorial Foundation (1970), and was honored as one of the Outstanding Young Men in America (1967).

Philips was born in Bertrand, Neb. in 1940. He received a B.A. in Political Science and Economics in 1962 at Nebraska Wesleyan University and a Master's Degree in Political Science at Arizona State University in 1963. He also has completed additional graduate studies at the University of Texas and at George Washington University.

NASA People Receive Important Awards

Individuals from NASA recently were singled out by the American Institute of Aeronautics and Astronautics as leaders in their chosen fields. They received five of ten AIAA awards given annually at ceremonies held at the 17th annual aerospace sciences meeting in New York City.

Recipients were:

- Richard S. Johnston, director of life sciences at the Johnson Space Center, who was praised "for exceptional leadership in the application of space flight technology to ground-based healthcare systems." (The Aerospace Contribution to Society Award.)
- John R. Casani, manager of the Galileo project at NASA's Jet Propulsion Laboratory, "for his personal contributions as the principal architect and system designer of the Galileo project, a pioneering attempt at planetary explorations." (Space Systems Award.)
- William L. Smith, manager of life and crew support systems, NASA headquarters, "for his outstanding contribution to the advancement of aerospace medical research in the development of innovative crew emergency and life-sustaining breathing and protective equipment in aeronautics and astronautics." (Jeffries Medical Research Award.)
- James B. Pollack, research and chief scientist, Ames Research Center, "for making major contributions to the theory of aerosols and the climatic influence of stratospheric aerosols." (Space Science Award.)
- Dean R. Chapman, director of astronautics at the Ames Research Center—the Dryden Lectureship in Research Award "intended to emphasize the great importance of basic research to advancement in aeronautics and astronautics and to be a salute to research scientists and engineers, and named in honor of Dr. Hugh L. Dryden, renowned leader in aerospace research programs.

Fire-Fighting Module Delivered to Coast Guard

Space technology has resulted in development of a lightweight, portable and highly efficient fire-fighting unit for use by the U.S. Coast Guard and other shipboard or harbor firefighters.

The Coast Guard called on NASA for help because engineers at the agency's Marshall Space Flight Center have developed a high degree of technology in designing efficient, lightweight pumps for rocket engines.

What NASA has developed and turned over to the Coast Guard is a unit 1.2 meters wide, 1.5 m high and 1.8 m long, weighing 1,134 kilograms. The weight includes fuel for three hours of operation and all other equipment, stored internally. The unit can

draw water from the sea or other source through a lift hose up to 6 m long and pump at least 4,732 liters per minute—about one-half the capacity of an average fireboat—through each of the unit's two water cannons, called monitors. Each monitor is made of lightweight fiberglass, weighing only 18 kg—half as much as a standard monitor. The small size and weight of the unit will permit it to be transported by helicopter sling, pickup truck or dolly. It also can be carried on boat decks.

Some commercial applications include the module's use on light trucks by local fire departments, use on docks and ships for harbor fires, for forest fires, offshore oil rigs and high-rise apartment buildings. It also can be used as an emergency booster pump for municipal water supplies, in flood control and in military operations.

The module can be set up rapidly by two persons without special tools and deliver a full output flow within 10 minutes. One lever controls all functions, including engine start, pump prime, normal flow, maximum flow and shutoff. The self-priming pump delivers full output flow within one minute of starting. No external power source is needed for priming.

A two-wheel trailer also is available to give the module road mobility. On this trailer it can be moved at road speeds by an automobile or light truck.

The project was directed by Marshall's technology utilization office as an engineering applications program. The unit was manufactured by NASA by the Northern Research and Engineering Corp., Cambridge, Mass.

Lewis Deputy Director Leaves NASA

Dr. Bernard Lubarsky left his post as deputy director of the Lewis Research Center in January to take a position with another federal agency.

Lubarsky joined Lewis in 1947. He held a variety of progressively more responsible positions in aeronautics propulsion, space propulsion and power, space communications, nuclear systems and terrestrial power conversion. He was named deputy director of the center in 1974. He served as acting center director from August 1977 until October 1978 when Dr. John F. McCarthy, Jr., became director.

McCarthy said: "His experience and wise counsel will be sorely missed. Dr. Lubarsky's reputation throughout NASA, and the high regard in which he is held by the Lewis staff, speak well of his tenure here."

Federal Women's Program Coordinator Named

Priscilla Elfrey has been named Federal Women's Program Coordinator at NASA headquarters, a position formerly held by Delores C. Handy. Handy recently was appointed acting director, headquarters Equal Opportunity Office. Elfrey will manage and direct the program.

Elfrey's most recent post was at Computer Sciences Corp., where she was a consultant and task leader for a study undertaken by DoE's Economic Regulatory Agency.

Before that she initiated services, directed programs, and created a comprehensive career advisory center as Associate Dean of Yale College. Elfrey chaired the Yale University Fellowships Committee and served on policy committees for community relations, professional and management classification, grievances, internships, social responsibility and the education of women. As EEO officer at New York University, she co-authored the Affirmative Action Plan, directed staff development activities from 1968 to 1972, and was project director of training grants. She has written and directed publication of personnel manuals, handbooks, and studies, and articles dealing with career development consulting and EEO.

Elfrey also has designed and led programs in communication, orientation, team building, organization development; and she has trained managers, staff, trainers, advisors and consultants in various jobs.

Elfrey did her undergraduate work at Barnard College and graduate studies at Columbia and New York University. She was a fellow of Calhoun College at Yale University from 1973 to 1978.

Jupiter Observation Continuing

Voyager 1 began a three-month period of systematic observation of the planet Jupiter and its major moons in early January.

From a vantage point of 60 million kilometers from Jupiter, its two cameras are taking photographs better than any taken from Earth. On Jan. 4, 1979, Voyager 1 was 598 million km from Earth, 16 months after its launch.

Voyager 1 is studying Jupiter and five of its satellites at close range. making measurements and taking more than 15,000 pictures during the three-month period. Eleven comprehensive scientific investigations will be performed as scientists probe the largest planet in the solar system and its more important satellites.

Closest approach to the planet as Voyager 1 flies past, will occur early on the morning of March 5, 1979. After flying past Jupiter and also studying the satellites Io, Europa, Ganymede, Callisto and Amalthea, Voyager 1 will begin a 20-month cruise toward the ringed planet Saturn.

Voyager 1 was launched Sept. 5, 1977, more than two weeks after its companion, Voyager 2. Voyager 1 flew a faster trajectory and is now almost four months ahead of Voyager 2, which is scheduled to make its closest approach on July 9.

The Voyager project is managed by the Jet Propulsion Laboratory, a government-owned facility in Pasadena, Calif., operated for NASA by the California Institute of Technology.

NASA Parachutist Sets Record

A Langley Research Center employee and a Fort Monroe officer set a Virginia parachute record with a jump of 9,500 meters at Fort Eustis. The previous record was 8,000 m.

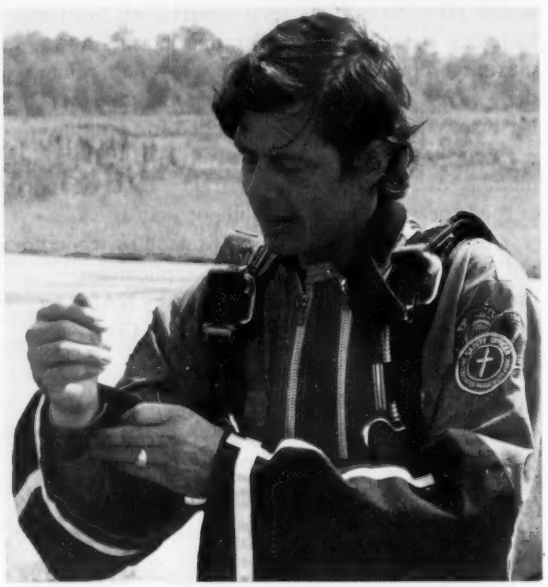
Philip Glaude, Langley fabrication division and Maj. Gen. Robert C. Hixon, chief of staff for the Army Training and Doctrine Command at Fort Monroe, made the military tactical jump from the Army's U-21, a twin-engine turboprop aircraft.

Facing 274 m/km winds and a temperature of 40 degrees below zero after leaving the plane, the men did a two-man hook-up at 8,500 m during their two-and-a-half minute free fall before opening their chutes at about 1,200 m.

The two used their regular sport jump equipment although sport jumps usually are only from 3,000 to 4,250 m, plus special equipment consisting of extra clothing, a helmet liner, two pair of goggles, insulated gloves and oxygen. They also wore inflatable life preservers, in case they landed in the water.

Glaude, who joined NASA in 1961, made his first jump in 1972, and in 1973 became a certified instructor. In six years of jumping, he said, he has not experienced any extreme hazards. He added that the greatest hazards were three parachute malfunctions, but that when a parachute malfunctions, he just releases himself from the main chute and pulls the reserve.

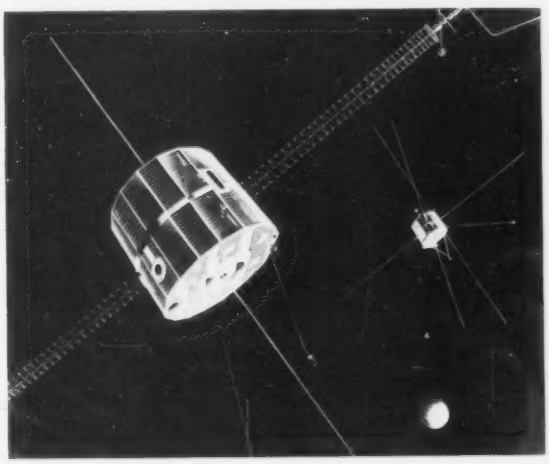
Glaude, has been jumping in competition for five years. In 1976 he finished 10th and in 1977 finished third in the eastern conference in accuracy jumping. He competed in the nationals for the first time in 1976 at Tahlequah, Okla. He was one of the jumpers who performed at the Langley family day activities in the summer of 1977.



Record Setter—Langley's Philip Glaude adjusts his parachute jumpsuit equipment.

Project Teams Recognized at Goddard—Special Achievement Awards accompanied by checks were presented to key members of the center's Nimbus 7 and International Sun-Earth Explorer (ISEE) project. Goddard director Dr. Robert S. Cooper officiated at ceremonies. The awards were given for carrying out the missions successfully, on time and some $4.5 million under target costs for the two missions. ISEE–3 was launched from Cape Canaveral Aug. 12, 1978, into a "halo orbit" 1.6 million kilometers above the Earth. ISEE 1 and 2 are still in orbit. The three satellites provide a unique opportunity to study the dynamic interaction of the solar wind and the Earth's magnetosphere. Nimbus 7 was launched from the Western Test Range in California Oct. 23, 1978, into a polar Earth orbit. Its sensitive instruments are designed to collect information on the atmosphere, the oceans, and pollutants. Photo shows Cooper (center) presenting a Special Achievement Award to Landsat/Nimbus Project manager Ronald K. Browning. Looking on at the right is Robert N. Lindley, director of projects at Goddard. ISEE 3 recipients were: Jeremiah J. Madden, Dr. Stephen J. Paddack, John A. Hrastar, William J. Schiavone, Martin A. Davis and Donald C. Lockerson. Nimbus 7 recipients were: Ronald K. Browning, Joseph A. Baden, Richard A. Devlin, George Hogan, Ralph B. Shapiro, William I. Gould, Jr., Joseph Arlaukas, James C. Redding and David J. Fromme. Don J. Fordyce, associate director of project management for the Projects Directorate, also received a Special Achievement Award for both projects.

Solar Array Wing—A 32-meter experimental solar array wing that will fly aboard NASA's Space Shuttle in the early 1980s is shown during a demonstration at the Lockheed Missiles & Space Co. in Sunnyvale, Calif. The accordian-like wing was extended and retracted, simulating what will take place during the experimental test flight. The Marshall center is managing the experiment, which is expected to verify technology for using lightweight solar arrays to supply electrical power during future orbital and interplanetary missions.



Space Twins—The Dynamics Explorers A and B, companions in space, will be launched in side-by-side polar orbits in 1981 to study the interaction between phenomena such as the northern lights and radio disturbances and how various forms of energy from space may influence weather on Earth. Astro-Electronics of Princeton, N.J. is manufacturing the spacecraft, which will investigate the magnetosphere, ionosphere and plasmasphere, and space energy sources. Scientists at the Goddard center and the Universities of Texas, Michigan, Iowa, and Stanford are developing instruments for the astronomical measurements. The two satellites will be launched by a single Delta rocket.

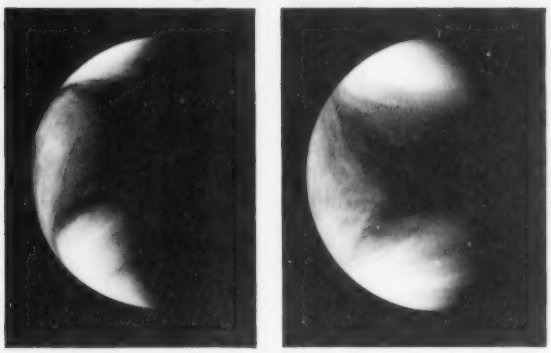
Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) and Employer	Title	Patent No.	Installation
Arthur P. Adamson, Donald F. Sargisson, Charles L. Stotler, Jr. — General Electric Co., Cincinnati, Ohio	Integrated gas turbine engine-nacelle	4,132,069	LeRC
Martin Hudis, Allis-Chalmers Milwaukee, Wis. Theodore Wydeven	Preparation of dielectric coatings of variable dielectric constant by plasma polymerization	4,132,829	ARC
Everett A. Johnston, General Electric Co., Cincinnati, Ohio	Variable area exhaust nozzle	4,102,068	LeRC
Richard T. Schneider, University of of Florida, Gainesville, Fla.	Safety flywheel	4,132,130	Hqs.
John E. Lamar, LaRC	Vortex-lift roll-control device	4,132,375	LaRC
Herman Bank, Edward L. Cleland — JPL	Gas Diffusion liquid storage bag and method of use for storing blood	4,132,594	NRLO
Grace L. Picciolo, GSFC Emmett W. Chappelle, GSFC	Determination of antimicrobial susceptibilities on infected urines without isolation	4,132,599	GSFC
Jody W. Deming, Christian G. Schrock, Hillar Vellend, Michael J. Barza, Louis Weinstein — New England Medical Ctr., Boston, Mass.			
Rudolf A. Schindler, JPL	Apparatus for providing a servo drive signal in a high-speed stepping interfermeter	4,132,940	NRLO
Wayne E. Arens, JPL	Azimuth correlator for realtime synthetic stepping interfermeter	4,132,989	NRLO
Robert L. Mueller, JPL Robert K. Yasui	Solar array strip and a method for forming the same	4,133,697	NRLO
Dean W. Sheibley, LeRC	Formulated plastic separators for soluble electrode cells	4,133,941	LeRC
Donald E. Jennings, National Academy of Sciences, Wash., D.C. John J. Hillman, GSFC	Thermal compensator for closed-cycle helium refrigerator	4,134,447	GSFC
Alexander F. H. Goetz, JPL Frederick P. Landauer, Jr.	Multispectral imaging and analysis system	4,134,683	NRLO
Victor S. Peterson, LeRC Robert D. Slewart, LeRC	Fine particulate capture device	4,134,744	LeRC
Marshall F. Humphrey, JPL	Process for purification of waste water produced by a Kraft process pulp and paper mill	4,134,786	NRLO
Shyam M. Khanna, MSFC Eugene W. Urban, Nat. Research Council, Wash., D.C.	Direct current transformer	4,135,127	MSFC
William R. Young, LaRC Charles W. Stump, LaRC	Apparatus for measuring an aircraft's speed and height	4,135,817	LaRC
Robert C. Bill, LeRC Lawrence P. Ludwig, LeRC	Composite seal for turbomachinery	4,135,851	LeRC
Harold E. Sliney, LeRC	Method of making bearing materials	4,136,211	LeRC
Robert H. Stroub, ARC	Constant lift rotor for a heavier than air craft	4,137,010	ARC
Theodore J. Wydeven, ARC John R. Hollahan	Oxygen post-treatment of plastic surfaces coated with plasma polymerized silicon-containing monomers	4,137,365	ARC

Launches for 1979

Name	Launch Date	Vehicle	Range	Mission Remarks
SCATHA	Jan. 30	Delta	ETR	DoD R&D. Spacecraft charging at high altitude Reimbursable.
SAGE-A	Feb. 18	Scout	WFC	NASA applications satellite. Stratospheric aerosol and gas experiment.
Navy-20, C/U	April	Scout	WTR	DoD Transit. Reimbursable.
NOAA-A	May 9	Atlas-F	WTR	NOAA weather satellite. Reimbursable.
FLTSATCOM-B	May	Atlas Centaur	ETR	DoD Navy communication satellite. Reimbursable.
UK-6	June	Scout	WFC	UK scientific satellite. Reimbursable.
Westar-C, C/U	August	Delta	ETR	Western Union communications satellite. Reimbursable.
Intelsat V-A	August	Atlas Centaur	ETR	Intelsat communications satellite. Reimbursable.
HEAO-C	September	Atlas Centaur	ETR	Third high energy astronomical observatory to study highly energetic radiation from space.
MAGSAT-A	September	Scout	WTR	NASA applications satellite to study magnetic field.
Navy-21	October	Scout	WTR	DoD transit satellite. Reimbursable.
SMM-A	October	Delta	ETR	NASA solar maximum mission satellite.
Space Shuttle	Nov. 9	Space Shuttle	ETR	First manned Shuttle orbital flight.
RCA-C	December	Delta	ETR	Domestic communications satellite. Reimbursable.



Two Faces of Venus—The image of Venus at left was obtained by the imaging experiment on the U.S. Pioneer Venus spacecraft on Dec. 25, 1978, at about the time the Soviet spacecraft Venera 11 parachuted through the atmosphere of Venus. Based on preliminary estimates provided by the Soviets for the time and location of the probe entry, the Russian craft should have descended along the equator near the planetary limb (lefternmost edge of image). This area is within the arms of a dark horizontal Y-shaped feature which stretches around much of the planet. The clouds in the region form cellular patterns suggestive of convective activity in the atmosphere. After this image and others taken before and after it have been analyzed, it may be possible to measure atmospheric winds from the displacement of clouds in successive images. This will be valuable for comparison with the Soviet measurements of wind speed which began at altitudes just below the cloud tops. The U.S. and Soviet space agencies have agreed to a future exchange of the data obtained by the spacecraft. The Pioneer Venus orbiter is expected to circle Venus for eight or nine months, thus providing data for an entire Venusian year. The image at right, constructed from data acquired 16 days later, again shows the dark, horizontal Y feature. It was made during a portion of the orbit when the spacecraft was nearly over the equator, thus the views of both hemispheres are comparable. The pronounced brightness of the clouds in the polar regions is typical of that exhibited in nearly all the Pioneer Venus images to date, with the degree of brightening substantially greater than that noted in Mariner 10 images of Venus in 1974.

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

A Fast Means of Distributing Photographs

News photographs now can be prepared by a high-speed, high-resolution facsimile system known as Laserfax, so called because it employs a laser beam to scan the photo being sent. Laser scanning data are converted to electrical signals and transmitted to new bureaus within the news service network via microwave radio or telephone lines. At the other end, another laser sweeps reconverted imagery onto a special, light-sensitive, dry silver paper. The paper is then heat processed to reproduce the photograph.

Lightning Transmission—An Associated Press technician receives a Laserfax photograph, later to be distributed to news bureaus, affiliated newspapers, and radio and television stations.

Manufactured by Harris Electronics Systems Inc.,* Melbourne, Fla., Laserfax incorporates NASA thermal control coating technology developed by the Jet Propulsion Laboratory for use on spacecraft antennas; the coatings block absorption of the solar radiation that would interfere with the antenna's proper operation.

The Harris company reused the NASA technology in development of Laserfax. A NASA Technical support package provided information about the thermal properties that could be expected of various coatings for the facsimile system's paper rollers; this information served as a design base for the infrared heat source used in developing the photo.

Although relatively new, Laserfax is in extensive service in several models. In addition to the news service model, others have been sold to law enforcement agencies for transmitting high quality fingerprints and identification photos. Laserfax also is used by the National Weather Service, which converts satellite imagery to weather photographs and relays them to local weather stations, television stations, newspapers and airlines.

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of such technology.

For the benefit of all . . .

NASA
National Aeronautics and Space Administration

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